

### **REMARKS**

Claims 1 and 15 are amended improve the clarity of the claim. Claim 18 is amended to correct the semantics of the claim. The specification is amended to indicate that Eh represents redox potential. No new matter is added by the amendments.

The disclosure is objected to as not specifically identifying "Eh" by name at least the first time "Eh" is employed. In particular, the definition as supplied is objected to as inconsistent with prior art use of the term. The specification is amended to identify "Eh" as a redox potential and is consistent with the use of Eh by those of ordinary skill in redox chemistry. Applicants request that the objection be withdrawn.

Claims 1-20 are rejected under 35 U.S.C. §112, first paragraph, as not enabled with respect to the term "Eh". Applicants traverse the rejection to the extent that it can be maintained.

The term "Eh", like the term "pH", is recognized and understood by those of ordinary skill with respect to electrochemistry. The specification is amended to recite "redox potential" the first time the concept is mentioned and the shorthand term "Eh" immediately follows in parentheses. Enclosed is a copy of an article briefly describing "Eh" and the method for calculating its value. Applicants respectfully request that the rejection be withdrawn.

Claims 1-20 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite with respect to the scope of the phrase "without the need for a collector". Applicants traverse the rejection to the extent that it can be maintained.

In claim 1, the phrase " without the need for a collector" occurs in the second step of the claimed method which recites "determining an Eh range within which the mineral may be recovered by flotation without the need of a collector". The phrase clearly relates to the determination of an Eh range. The third step of the claimed method relates to flotation of a slurry in a pneumatic cell and only requires that the slurry remain in the Eh range determined by step two. "Without the need of a collector" relates to determining the Eh range and does not relate to flotation per se. Claim 15 recites that an Eh range of the slurry within which floatation occurs, i.e. step three of claim 1, and is a range within which valuable sulphide mineral may be

recovered by flotation with out the need of a xanthate collector. Claim 1 characterizes the determination of a suitable Eh range for the mineral recovery process, and claim 15 characterizes an Eh range for the slurry in which flotation can occur without the need of a collector. Claim 17 simply recognizes that a collector is not limited to a xanthate collector. Applicants respectfully submit that the scope of each claim is clear and unambiguous to a person of ordinary skill in the art.

With respect to the term "scalper" in claim 18, Applicants submit that the term is well known to persons of ordinary skill in mineral recovery technology. "Scalping" refers to the process of separating differently sized lumps on a continuous basis from a stream of bulk material. "Scalper" is simply the device for performing the scalping operation.

Applicants respectfully remind Examiner that claim 20 was amended in the paper filed December 30, 2003 to address the indefiniteness issue with respect to "the remainder of the flotation circuit".

In light of the above comments, Applicants respectfully request that the indefiniteness rejections of claims 1-20 be withdrawn.

Claims 1-11, 13 and 15-20 are rejected under 35 U.S.C. §103(a) as being unpatentable over Kennedy (Mining Magazine) in view of Heimala et al. (US 4,561,970). Applicants traverse the rejection to the extent that it can be maintained.

As a preliminary matter, the pneumatic flotation process, as represented by the Jameson cell, was not developed until the mid-1980s. A copy of a press release from the University of Newcastle dated November 2002 announcing an award to Professor Jameson for his invention of the pneumatic cell is enclosed. In the release, Professor Jameson states that the pneumatic cell bearing his name was invented in 1986.

The Kennedy article describes the state of the art of pneumatic flotation technology, in particular, the Jameson cell. The article describes various features of the Jameson cell and benefits therefrom. There is no mention in the article of collectors or of controlling Eh to improve the cost and efficiency of the flotation process. The Heimala et al. patent issued

December 31, 1985. Since the technology disclosed by Heimala et al. predates the invention of the pneumatic cell, the reasonable conclusion is that the Heimala et al. process employs a mechanical, not a pneumatic, flotation cell. The Kennedy article and the Heimala et al. patent relate to different flotation technology, and there is no motivation to combine these references as done in the Office Action to arrive at the claimed invention. Nevertheless, even if Heimala et al. process refers to a pneumatic cell, a point the Applicants do not concede, it would not in combination with Kennedy teach or suggest Applicants' invention. Heimala et al. states that it is important to measure the potential continually throughout the process, and that direct electrochemical regulation is reliable and successful (column 4 lines 31-39). Further, the Heimala et al. process requires controlling pH, Eh and collector levels to achieve selectivity with respect to separating different mineral values by flotation (Abstract and column 2 lines 26-40). In sharp contrast, Applicants' process determines an Eh within which the mineral may be recovered by flotation without the need of a collector and then simply performs flotation at a rate such that the Eh remains in the predetermined range. In the Applicants' process, the Eh is allowed to fluctuate within the predetermined range. Applicants respectfully submit that Kennedy and Heimala et al. are not combinable as each relates to a different froth flotation technology, and if combined, they would require controlling Eh of the slurry in a pneumatic cell which does not teach or suggest Applicants' invention. For the reasons stated claim 1 is allowable over the cited art. Claims 2-11, 13 and 15-17 depended directly or indirectly from claim 1, and therefore, are likewise allowable. With respect to claim 18, none of the cited art teach or suggest a pneumatic cell as an upstream scalper of a flotation circuit. As the prior art fails to teach all of the elements of claim 18, the claim is not obvious in light of the cited art. Claims 19-20 depend from claim 18 and are also not obvious in view of the art. The Examiner is requested to withdraw the rejection of claims 1-11, 13 and 15-20 on this ground.

Claims 1-19 are rejected under 35 U.S.C. §103(a) as being unpatentable over Kennedy (Mining Magazine) in view of Australasian IMME-1984 (AIMME). Applicants traverse the rejection to the extent that it can be maintained.

The Kennedy article is discussed above. The Australasian article, like the Heimala et al. patent, pre-dates the invention of the pneumatic flotation cell. Therefore, the article can

reasonably be construed to only disclose a flotation process (e.g. mechanical) which is completely different from the pneumatic cell process. The Kennedy and AIMME articles refer to different flotation technologies, and there is no teaching or suggestion that process conditions suitable for one technology is suitable for the other. Even if the references are combinable, a point that the Applicants do not concede, they suggest that a pneumatic cell may achieve collectorless flotation if the Eh of the slurry pulp is controlled during the process. As the Office Action points out, the AIMME article discloses that self-induced flotation is achieved by controlling the redox potential of the pulp slurry. This sharply contrasts Applicants invention that determines an Eh range for flotation and then allows Eh to fluctuate within the range as air is added to the flotation slurry. As explained at page 6, line 23, the invention provides a process for flotation to occur with sufficient rapidity so as to avoid the Eh going outside the range for collector free flotation. Applicants respectfully submit that Kennedy and AIMME articles are not combinable as each relates to a different froth flotation technology, and if combined, they do not teach or suggest Applicants' invention. The Examiner is requested to withdraw the rejection of claims 1-19 on this ground.

Claims 1-13 and 15 are rejected under 35 U.S.C. §103(a) as being unpatentable over Kennedy (Mining Magazine) in view of Ahn et al. (IJMP). Applicants traverse the rejection to the extent that it can be maintained.

The Kennedy article is discussed above. The IJMP article describes self-induced flotation of chalcopyrite by controlling the redox potential of the slurry pulp. Further, the IJMP article involves a mechanical flotation cell as opposed to the pneumatic cell of the invention. Although the article may not expressly mention mechanical cells, the experimental method section of the article indicates that the cell includes an impeller and gas distribution assembly (page 245). These are precisely the essential structural features of a mechanical cell, and are not part of the pneumatic cell described by Kennedy (Fig. 1). Kennedy and the IJMP articles refer to structurally different flotation technologies and are not combinable. Further, if combined, would suggest that collectorless flotation could be achieved by controlling the Eh during the flotation process as opposed to allowing the Eh to fluctuate within a predetermined range. Applicants respectfully submit that Kennedy and IJMP articles are not combinable as each relates to a

• Appl. No. 09/787,051  
Amdt. dated September 10, 2004  
Reply to Office Action of March 10, 2004

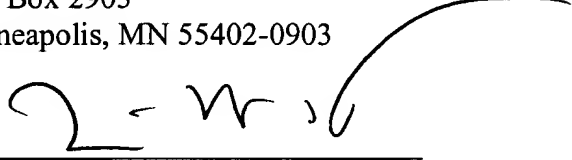
different froth flotation technology, and if combined, they do not teach or suggest Applicants' invention. Examiner is requested to withdraw the rejection of claims 1-13 and 15 on this ground.

In view of the above amendments and remarks, Applicant respectfully requests a Notice of Allowance. If the Examiner believes a telephone conference would advance the prosecution of this application, the Examiner is invited to telephone the undersigned at 612/332-5300.

Respectfully submitted,

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Dated: 9 September 2004

  
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[University > News & Events > Media Releases](#)**Monday 11th November 2002**

**Professor Graeme Jameson**

## Researcher Receives Highest Chemical Engineering Award

University of Newcastle researcher Professor Graeme Jameson has been awarded the prestigious Chemeca Medal for his revolutionary research in chemical engineering.

The inventor of the Jameson Cell received the award from the 30th Annual Australasian Chemical Engineering Conference CHEMECA 2002 for his research.

Professor Jameson says that the Cell invented in laboratories at the University of Newcastle in 1986 is only now beginning to reach its full potential.

"The Jameson Cell uses the flotation process to remove particles from suspensions. Bubbles are used to separate particles from liquid wastewater streams."

"The Cell was developed initially for mineral processing and allows for valuable materials such as copper, lead, zinc, nickel and gold minerals to be recovered."

"The coal industry is now using the technology to recover fine coal from waste streams which gives a clean coal product which is highly valued in the export market."

"This equates to a boost of approximately \$800 million to the economy each year," said Professor Jameson.

The Jameson Cell is now being marketed worldwide and is currently being used in water treatment for the removal of blue green algae from domestic water treatment plants.

Professor Jameson is the Director of the University's Centre for Multiphase Processes, a major centre for research and research training in the science and technology of fine particles and bubbles.

He has published over 200 articles in scientific journals and is recognised for his contribution to the establishment of the discipline of Chemical Engineering at the University of Newcastle.

**For Interviews: Professor Graeme Jameson on (02) 4921 8161.**

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# Redox Theory



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Just as the transfer of hydrogen ions between chemical species determines the pH of an aqueous solution, the transfer of electrons between chemical species determines the redox potential of an aqueous solution. The term redox comes from oxidation / reduction potential or ORP and is measured in units of volts, millivolts or Eh ( $1\text{Eh} = 1\text{mV}$ ). Oxidation occurs when a species loses an electron and reduction occurs when a species gains an electron. There is no reduction without an accompanying oxidation, and vice versa.

The redox potential measures the tendency for a solution to either gain or lose electrons when it is subject to change by introduction of a new species. A solution with a higher redox potential will have a tendency to gain electrons from new species (i.e. oxidize them) and a solution with a lower redox potential will have a tendency to lose electrons to new species (i.e. reduce them).

pH and Eh together with the activity of dissolved chemical species characterise chemical reactions in aqueous solutions. Like pH, Eh represents an intensity factor. It does not characterise the capacity of the system for oxidation or reduction, in much the same way that pH does not characterise the buffering capacity.

Although measurement of the redox potential in aqueous samples is relatively straightforward, many factors limit its interpretation, such as irreversible reactions, slow electrode kinetics, non-equilibrium, presence of multiple redox couples, electrode poisoning, small exchange currents and inert redox couples. Consequently, practical measurements seldom correlate with calculated values. Nevertheless, redox measurement has proven useful as an analytical tool in monitoring changes in a system rather than determining their absolute value (e.g. process control and titrations).

Redox values are determined by measuring the potential difference between an inert indicator electrode in contact with the solution and a stable reference electrode connected to the solution by a salt bridge. The indicator electrode acts as a platform for electron transfer to or from the reference half cell. It is typically platinum, although gold and graphite can be used. The reference half cell consists of a redox standard of known potential. The standard hydrogen electrode (SHE) is the reference from which all standard redox potentials are determined and has been assigned an arbitrary half cell potential of 0.0 mV. However, it is fragile and impractical for routine laboratory use. Therefore, Ag/AgCl and saturated calomel (SCE) reference electrodes are commonly used. The voltages of the different reference electrodes can be interrelated using Table 3. The IJ64 uses a saturated KCl Ag/AgCl reference electrode.

Table 3: Potential Relationships of Several Reference Electrodes at 25°C (mV)				
SHE	SCE Saturated KCl	Ag/AgCl 1M KCl	Ag/AgCl 4M KCl	Ag/AgCl Saturated KCl (IJ reference)
0	+245	+236	+200	+199

For example: If you had a reading of 100mV using a saturated KCl Ag/AgCl reference and wanted to refer it back to an SHE you would add 199mV to obtain 299mV. Alternatively, if you took a reading in the same solution using an SCE,

you would obtain 54mV (subtract 46mV from 100mV).